

## C L A I M S

What is claimed is:

- 1 1. A system for directly measuring a magnetostriction  
2 value of a magnetoresistive element, the system  
3 comprising:  
4 a fixture for receiving a substrate carrying one or  
5 more magnetoresistive elements;  
6 a magnet assembly for applying a first magnetic field  
7 parallel to the substrate, and for applying a  
8 magnetic alternating field perpendicular to the  
9 substrate and parallel to magnetoresistive layers  
10 of the elements;  
11 a mechanism for applying a mechanical stress to the  
12 substrate, the stress being oriented parallel to  
13 the substrate; and  
14 a measuring subsystem for measuring a signal from at  
15 least one of the magnetoresistive elements.
- 1 2. A system according to claim 1, wherein the substrate  
2 is a row or a wafer.
- 1 3. A system according to claim 2, wherein the row or  
2 wafer carries a plurality of the magnetoresistive  
3 elements.
- 1 4. A system according to claim 1, wherein the first  
2 magnetic field is a DC field.

- 1 5. A system according to claim 1, wherein the measuring  
2 subsystem is locked to a frequency of the alternating  
3 field.
- 1 6. A system according to claim 1, wherein the signal from  
2 the at least one of the magnetoresistive elements is  
3 measured before the mechanical stress is applied;  
4 wherein, after applying the mechanical stress, the  
5 first magnetic field is changed until the signal being  
6 measured co-currently thereto about matches the signal  
7 measured before applying the mechanical stress.
- 1 7. A system according to claim 1, wherein the mechanism  
2 for applying the mechanical stress causes the  
3 substrate to bend.
- 1 8. A system according to claim 7, wherein the mechanism  
2 for applying the mechanical stress is a micrometer  
3 screw.
- 1 9. A system according to claim 8, wherein the micrometer  
2 screw is electronically controlled.
- 1 10. A system according to claim 1, wherein the mechanism  
2 for applying the mechanical stress is a heat source.
- 1 11. A system according to claim 1, wherein the mechanism  
2 for applying the mechanical stress is a piezo layer.
- 1 12. A system according to claim 1, further comprising a  
2 controller for changing the first magnetic field.

- 1 13. A system according to claim 12, further comprising a  
2 computing device for calculating a magnetostriction  
3 constant of the at least one magnetoresistive element  
4 based in part on a change of mechanical stress  
5 anisotropy due to application of the mechanical stress  
6 and the change in the first magnetic field.
- 1 14. A system according to claim 1, wherein the at least  
2 one magnetoresistive element includes shielding  
3 layers, wherein the first magnetic field is calibrated  
4 to reflect an influence of a demagnetizing effect of  
5 the shielding layers on the element.
- 1 15. A system according to claim 1, wherein the  
2 magnetoresistive element is an Anisotropic  
3 Magnetoresistance (AMR)-, Giant Magnetoresistance  
4 (GMR)- or Tunneling Magnetoresistance (TMR)-based  
5 sensor.
- 1 16. A system according to claim 1, wherein the  
2 magnetoresistive elements are magnetic memory  
3 elements.
- 1 17. A system for directly measuring a magnetostriction  
2 value of a magnetoresistive element, the system  
3 comprising:  
4 a bending fixture for receiving a substrate carrying  
5 one or more magnetoresistive elements;  
6 a magnet assembly for applying a magnetic direct  
7 current (DC) field parallel to the substrate, and

8           for applying a magnetic alternating field  
9           perpendicular to the substrate and parallel to  
10          magnetoresistive layers of the elements;  
11   a mechanism for applying a mechanical stress to the  
12          substrate by bending the substrate, the stress  
13          being oriented parallel to the substrate;  
14   a control circuit for changing the DC magnetic field;  
15          and  
16   a measuring subsystem for measuring a signal from at  
17          least one of the magnetoresistive elements prior  
18          to application of the mechanical stress, after  
19          application of the mechanical stress, and during  
20          a time period when the DC magnetic field is  
21          changed.

1   18.   A system for directly measuring a magnetostriction  
2          value of a magnetoresistive element, the system  
3          comprising:  
4          a bending fixture for receiving a substrate carrying  
5                  one or more magnetoresistive elements;  
6          a magnet assembly for applying a magnetic direct  
7                  current (DC) field parallel to the substrate, and  
8                  for applying a magnetic alternating field  
9                  perpendicular to the substrate and parallel to  
10          magnetoresistive layers of the elements;  
11       a DC power supply for providing power to the magnet  
12          assembly;  
13       an alternating current (AC) power supply for providing  
14          power to the magnet assembly;

15 a mechanism for applying a mechanical stress to the  
16 substrate by bending the substrate, the stress  
17 being oriented parallel to the substrate;  
18 a measuring subsystem for measuring a signal from at  
19 least one of the magnetoresistive elements prior  
20 to application of the mechanical stress, after  
21 application of the mechanical stress, and during  
22 a time period when the DC magnetic field is  
23 changed;  
24 a control circuit for changing the DC magnetic field  
25 until the signal currently being measured by the  
26 measuring subsystem about matches a signal  
27 measured before applying the mechanical stress;  
28 and  
29 a computing device for calculating a magnetostriction  
30 constant of the at least one magnetoresistive  
31 element based in part on a change of mechanical  
32 stress anisotropy due to application of the  
33 mechanical stress and the change in the DC  
34 magnetic field.

1 19. A method for directly measuring a magnetostriction  
2 value of a magnetoresistive element, the method  
3 comprising:  
4 providing a substrate carrying one or more  
5 magnetoresistive elements;  
6 placing the substrate on a fixture;  
7 applying a first magnetic field parallel to the  
8 substrate;

9       applying a magnetic alternating field perpendicular to  
10       the substrate and parallel to magnetoresistive  
11       layers of the elements;  
12       measuring a signal from the element;  
13       applying a mechanical stress to the substrate, the  
14       stress being oriented parallel to the substrate;  
15       and  
16       changing the first magnetic field until the signal  
17       currently being measured about matches a signal  
18       measured before applying the mechanical stress.

1   20.   A method according to claim 19, wherein the substrate  
2       is a row or a wafer.

1   21.   A method according to claim 20, wherein the row or  
2       wafer carries a plurality of the magnetoresistive  
3       elements.

1   22.   A system according to claim 19, wherein the mechanical  
2       stress causes the substrate to bend.

1   23.   A method according to claim 22, wherein the mechanical  
2       stress is applied by a micrometer screw.

1   24.   A method according to claim 19, wherein the  
2       magnetoresistive element is an Anisotropic  
3       Magnetoresistance (AMR)-, Giant Magnetoresistance  
4       (GMR)- or Tunneling Magnetoresistance (TMR)-based  
5       sensor.

1 25. A method for directly measuring a magnetostriction  
2 value of a magnetoresistive element, the method  
3 comprising:  
4 providing a substrate carrying one or more  
5 magnetoresistive elements;  
6 placing the substrate on a bending fixture;  
7 applying a magnetic DC field parallel to the  
8 substrate;  
9 applying a magnetic alternating field perpendicular to  
10 the substrate and parallel to magnetoresistive  
11 layers of the elements;  
12 measuring a signal from at least one element;  
13 applying a mechanical stress to the substrate by  
14 bending the substrate, the stress being oriented  
15 parallel to the substrate;  
16 changing the magnetic DC field until the signal  
17 currently being measured about matches a signal  
18 measured before applying the mechanical stress;  
19 and  
20 calculating a magnetostriction value of the element.